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THE LOS ANGELES MEETING OF THE AMERICAN CHEMICAL SOCIETY

THE Southern California Section of the American Chemical Society were hosts for the seventieth meeting, held at Los Angeles from August 3 to 8, inclusive. More than two hundred made the journey from Chicago on a special train, following a delightful afternoon and evening as guests of the Chicago Chemists Club at the campus of Northwestern University in Evanston. The special train gave an opportunity for enjoying the attractions of Colorado Springs, Santa Fe, New Mexico, Albuquerque and Isleta, as well as the Grand Canyon of the Colorado.

California chemists to the number of twenty-five met the train at Riverside, where after luncheon at the Mission Inn, the party proceeded by auto to the Southland ranch at Corona, where a complete demonstration of the methods used in fumigating citrus groves with liquid hydrocyanic acid gas was given. At the Lemonia grove the party was treated to all sorts of luscious fruits and heard something of the history of the citrus industry in California and something of the operation of the Exchange Lemon Products Company which operates two factories producing citric acid and other products from lemons.

The serious work of the meeting began with the council meeting on August 3. It was announced that the semicentennial meeting of the society would be held in Philadelphia the week beginning September 6, 1926, and that it is expected that the International Union of Pure and Applied Chemistry will meet the following week in Washington. The council unanimously passed the following resolution concerning chemical warfare.

WHEREAS, At a meeting in Geneva, Switzerland, in May and June, 1925, called for an entirely different purpose, a protocol was drafted and signed purporting to outlaw the use of chemicals in war by agreement.

WHEREAS, The Geneva Conference was not only without technical advice on this vital national question of chemistry, but showed in their discussions a lamentable lack of understanding of chemical warfare and the dangers of hasty and ill-considered action, and

WHEREAS, The chemical and military experts in the Washington Conference of 1921 and 1922, after full discussion, recommended that it was against national safety to try to outlaw chemical warfare, which should be considered and controlled in war exactly as any other material or method of waging war; therefore, be it

Resolved, That the American Chemical Society meeting in convention in Los Angeles, California, goes strongly on

record against the ratification of the Geneva protocol on poisonous gases, as against both national safety and on the grounds of humanity.

The council also passed the following resolution offered by the Metric Committee:

WHEREAS, Those scientifically trained find the metric system of weights and measures more convenient to use than the English system; be it

Resolved, that the Council of the American Chemical Society request the manufacturers of photographic plates, films and chemicals to publish approved metric formulas in addition to the English formulas.

Special attention was called to the necessity of reaching an early decision regarding the publication of the second decennial Index to Chemical Abstracts, for which to date insufficient subscriptions have been received to warrant the directors in authorizing the very considerable work involved. Unless a sufficient sum is guaranteed by December 1, the advance subscriptions will be refunded and the project abandoned.

A new section of the society, to be known as the Northern Louisiana Section, with headquarters at Shreveport was authorized, and the name of the Southern Indiana Section changed to the St. Joseph Valley Section at its request.

A. M. Comey, of Cambridge, Mass., was reelected a member of the executive committee. J. F. Norris, professor at the Massachusetts Institute of Technology and now president of the society, and S. C. Lind, assistant director of the Fixed Nitrogen Research Laboratory, Washington, were elected to the board of the *Journal* of the American Chemical Society. Professor John Johnston, of Yale, F. W. Willard, of the Western Electric Company, and R. E. Wilson, of the Standard Oil Company of Indiana, were reelected to the editorial board of *Technologic Monographs*. Dr. Charles L. Parsons, of Washington, was reelected secretary for a term of three years.

The next meeting of the society will be held in the spring of 1926 at Tulsa, Okla., followed by the semicentennial meeting in September of that year at Philadelphia. The section at Richmond, Va., will entertain the society in the spring of 1927 with Detroit as the meeting place in the autumn of 1927.

At the general meeting open to the public, Alexander Findlay, of Glasgow, delivered an address on "The twilight zone of matter," and W. R. Whitney, of the General Electric Company, gave an unusual address on "Matter—is there anything in it?" profusely illustrated with special experiments arranged for the occasion and performed with apparatus taken to Los Angeles for the purpose.

Owing to the distance and the difficulty of arranging extended programs under the circumstances, several divisions and sections met jointly. The Divisions of Agricultural and Food Chemistry and of Biological Chemistry held a symposium on Chemistry and Plant Life, of which Charles D. Lipman, of the University of California, was chairman. The papers dealt principally with energy relations and physiological processes in plant metabolism and were followed by a group of papers dealing with the properties of starches, plant sterols, the activity of plant enzymes and the influence of certain chemicals upon plant growth and development. The general program of these divisions dealt with plant chemistry, human and animal nutrition, the chemistry of casein and the coagulation of milk.

The Insecticide and Fungicide Symposium was under the chairmanship of George B. Gray and considered petroleum insecticides, sulfur-oil combinations, the arsenates, the use of potassium xanthate as a soil insecticide, and the absorption of hydrocyanic acid for dried fruit products.

The Division of Sugar Chemistry joined the Divisions of Agricultural and Food and Biological Chemistry in a Pectin Symposium of which W. H. Dore was chairman. The need of uniform nomenclature on pectin was stressed and a committee appointed to study the situation and make recommendations. In the course of the symposium various phases from the composition of pectin to its manufacture and the requirements of pectin for the commercial jelly-maker were discussed.

The joint meeting of the Division of Chemical Education with the Section of the History of Chemistry attracted a large attendance, particular attention being given to a discussion of "What are our objectives in teaching chemistry?" This involved a discussion of the methods of presenting chemistry. One speaker stated the chief objective to be to teach the student how to get the facts rather than the facts themselves; another that the laboratory must be made a place for thinking instead of mechanical test-tubing, and that the scientific method must be closely followed in presenting the subject of chemistry. Another speaker insisted upon personal contact with the student as the prime essential, believing that most of the instruction should be given in the laboratory. In the discussion vigorous objection was made to the suggestion that it is at all possible to measure in percentages the gain or loss of intellectual processes. Both fact and ideas are necessary for the advancement of science, but to attain this it is doubtful if standard tests are advisable, since such tests are too apt to overshadow the real value of the subject.

The symposium was followed by a number of papers on various phases of the teaching and the history of chemistry.

The Divisions of Industrial and Engineering Chemistry and of Cellulose Chemistry held a joint meeting with the Section of Paint and Varnish Chemistry. The chemical industries of the West was the subject of a symposium with Charles A. Newhall as chairman. The progress of nitrogen fixation in the State of Washington was discussed, an interesting paper on the decomposition of liquid hydrocyanic acid presented, and a novel method for the manufacture of hydrochloric acid from chlorine given in some detail. Motor benzene and motor alcohol were the subject of two papers giving the status of this work in the West. Among the general papers was one by Professor Alexander Silverman, of the University of Pittsburgh, on the conservation of fuel and public health, in which statistics were presented showing losses due to the practice of allowing taxicab motors to idle, especially where the cabs are not provided with self-starters. There is not only an economic loss, but a considerable hazard to public health, due to the large quantities of carbon monoxide discharged.

The meetings of the Division of Organic Chemistry held jointly with the Division of Chemistry of Medicinal Products brought out seventeen papers, an unusually short program for these divisions. The principal discussions centered about the reactivity of alcohols and the toxicity of local anesthetics.

The Division of Petroleum Chemistry met with the Division of Gas and Fuel Chemistry in a successful meeting, the papers treating the various phases of the petroleum industry and gas and other fuels. An outstanding paper was that by R. E. Wilson on the prevention of evaporation losses from gasoline storage tanks, wherein breather bags are employed to permit the contraction and expansion of the air and vapor without loss.

A paper by Berry and Brown called attention to the effect of the fuel oil situation on gas company operations and the necessity, especially on the part of Pacific Coast gas companies, of research in the effort to develop other sources of raw material for gas production.

The Division of Physical and Inorganic Chemistry held a symposium on strong electrolytes with Professor Alexander Findlay presiding. This was followed by twenty-one papers on a great variety of topics which occupied three half-day sessions.

Before the Division of Sugar Chemistry ten papers of unusual quality were presented, the outstanding one being that by J. H. Bon and A. A. Blowski on decolorizing carbons. Two papers on the preparation of levulose from artichokes brought out the fact that this year for the first time dahlias have been successfully started from seed, thereby removing the greatest objection to the dahlia as a raw material for the manufacture of levulose.

The meeting was characterized by a particularly enjoyable program of entertainment in addition to the interest shown in the scientific part of the program. Besides visiting the oil fields, several industrial plants in the vicinity, and Hollywood, those attending the meeting were entertained at an avocado luncheon, enjoyed dinner and dancing at the Miromar at Santa Monica, took part in a frolic at the hotel, and enjoyed a banquet at which President J. F. Norris gave his address. The meeting concluded with an afternoon and night on Mount Wilson, followed by an inspection of the laboratories in Pasadena and the demonstration of some of the equipment in the million volt laboratory of the California Institute of Technology. After a concluding luncheon, the party took up the post-convention program. This included a visit to the plant of the Trona Corporation at Searles Lake, an informal meeting at San Francisco where industrial plants and the great educational institutions were visited, and sightseeing about California and in the northwest, particularly at Portland and Mount Rainier.

The attendance at the meeting gave a total of 878, three being from Canada, one from India, one from the Philippine Islands, and two from Scotland.

H. E. HOWE

SERVICE OF THE AMERICAN CHEMICAL SOCIETY TO THE NATION[1]

THE happy idea of the local committee of having the president give his address at the close of the banquet has resulted in a lack of formality very agreeable to the speaker. I have been tempted to talk informally in an after-dinner style, but tradition demands the serious consideration of a subject of vital importance. In his admirable address last year, Dr. Baekeland stated that he had read the addresses of all the past presidents of the society. I had not the courage to follow his excellent example. I was afraid that I should find that all the words of wisdom had been spoken; that all the valuable ideas had been expressed. I did not want to be hampered by the thought that I was but repeating what had been better said by others. So the problem of this talk was approached in a way not in accord with the scientific method. Ignorant of the literature of presidential addresses some thoughts were written down boldly with confidence in the good luck that mysteriously looks after the cheerful in spirit.

[1] Given at a banquet in connection with the seventieth meeting of the society, Biltmore Hotel, Los Angeles, California, on August 6, 1925.

The attitude taken is consistent with looking ahead rather than behind. The cautious man governs his actions with a knowledge of the past. The statesman acts in the light of history. The reformer does not. The promulgators of revolutionary ideas have been ignorant of the facts or have disregarded them. They brought a fresh point of view to affairs. Their very ignorance of what experience had shown to be impossible made the impossible possible. I hope I have caught some of this spirit. At least I have dared to build castles in the air.

These commonplace remarks have been made not only to excuse myself of ignorance of the wise words of my predecessors, but also as a kind of preamble to an outline of some fascinating dreams that have floated before some of us who have keenly at heart the welfare of our great society. We have had a glorious past, the story of which will arouse us to enthusiasm when we hear it.

A year from now we shall have completed the fiftieth year of a continued progress in chemistry since the foundation of the American Chemical Society. We shall then stop to hear of great achievements. But to-day we can look to the future. Some years ago I saw a striking play in which two young men were rivals for the hand of the heroine. One was continually boasting of his blue blood; his ancestors dated back to Mayflower days and beyond. The other was a nobody of force and character. He finally silenced his rival and won his lady love by saying he had made up his mind that he himself would rather be an ancestor than a descendant.

How can we apply the incident to the American Chemical Society? Fifty years of achievement are about to become a part of the ages. Let us then turn from the past and look to the future. Which path shall we take of those that lie before us? How can the society best serve the nation, chemistry and us who are giving our lives to the science? Evidently by making chemistry more vital in the development of civilization and in adding to the happiness, comfort and wealth of the people; by increasing the fundamental knowledge of our building blocks, the atoms and of the mechanism of their interaction; and finally by continuing our work of educating the people in regard to what a potent factor chemistry has been and is to-day in the march of civilization. We all recognize the fact that in the last few years the attitude of the public toward the chemist has changed. He is a man of achievement, a wonder-maker. Everybody is glad to know a chemist to-day and looks on him as almost a superman.

How can we take advantage of the great start we have made? Chemistry in America is forging ahead at a rate that startles the world. I have just returned from Europe, where I was one of those who represented America in international gatherings devoted to chemistry. On all sides our achievements are recognized. American chemistry was honored in many ways and always was given the place of distinction. We have only begun our activities and there is much to do before we can finally say we lead the world. When we calmly review the grand advances in pure and applied chemistry that have earned the wonder of the world in the last decade, we are chagrined to find that we played no important part in them. We are but followers in the study of the atom; we marvel at the application of known knowledge to the synthesis of compounds of such technical significance as ammonia, acetic acid and methanol. And we have added only a bit here and there.

Let us see to it that such triumphs are born here in America. I am an enthusiastic internationalist and science is international; but we all have a particular pride which is natural and commendable in the achievements of those close to us. Every father wants his own boy to succeed. It is not provincial to want America to take the lead in chemistry.

I again ask the question: What can we do to win the first place and how can our society help? The answer to the first part of the question is self-evident to all, but the way to bring about the result is a problem for serious thought. We must increase the productiveness of research. During the past year I have been studying with great care the relationship between chemical research and industrial development. I have visited some of our largest industries based on chemistry and have seen the part played in their development by the work done in their own research laboratories and by that produced by the investigators in universities. I was markedly impressed by the fact that the industries are prepared to utilize at once the results of research in what for a better name is called pure science. They are supplied with chemists of the best training and of the highest type, who follow eagerly the world's publications. In a paper apparently of theoretical interest is found a fact that the technical man sees he can apply. In one great laboratory I found most of the research men feverishly carrying out work that was suggested by papers published by two university professors—one in Canada and the other in Germany.

The lesson to be drawn was clear. The work that can be done in the research laboratory of a great chemical organization is of one type—that done in the university laboratory is of another. But both must be done—one springs from the other. All industrial scientific advance has its roots in the academic soil.

We are safe in this country to leave the application of chemistry to those who are at present guiding our industries. We of the academic fraternity must see to it that we furnish the acorns from which mighty oaks will grow.

These statements bring me to one of the major subjects of my talk, namely, the relationship between academic research and industrial progress in chemistry. Wherever great progress has been made the importance of this relationship has been recognized. We could well study and follow the example of Germany. It has been my good fortune to see something of the cooperation between the great masters in research and the industrial organizations that have given German chemistry such high rank. Let us copy what has proved to be of great success. I am glad to note that such cooperation is increasing in this country. The man who is devoting his life to the study of a particular field of chemistry, who is adding to the world's knowledge by research, and who knows the details of what has been done can not help but be of the greatest value to the industry based upon his specialty. I have seen and taken part in the industrial development of chemical processes and know that the men directly concerned with the development are aided by the academic investigator, who approaches the subject from a more or less detached point of view. I feel confident that our industries will advance more rapidly when they seek more freely such scientific contacts.

The industries can help themselves in another way. They can formulate problems for research of a fundamental character based on their experience. The industrial research laboratories have all they can do to solve the immediate problems as they arise from day to day. They must deliver a process that works —the dollar mark is the vital symbol in all industrial chemical equations, as our friend Walker puts it. They can not stop to investigate the very fundamental facts and relationships underlying the processes used. It may take years, and new problems are pressing for solution. Many cases could be cited. We have been cracking petroleum for years, but what do we know of it from the standpoint of real organic chemistry? What do we know of the relationship between lubrication and the chemical composition of the lubricant? Who will solve the chemical problem of vulcanization? A start has been made to get into the hands of the academic investigator many fundamental problems which must be solved before many of our industries can pass from the realm of the arts to that of applied science. But much more can be done in this direction. Many men in our universities and colleges are eager to undertake the study of these fundamental problems, but they do not know where to begin or what to study. They do not care to attempt to solve the immediate technical problems—that is the business of the industry itself and should be paid for in dollars.

Although some men of the highest rank look askance at anything of a technical nature, I am sure every one takes joy in seeing the fruits of his genius and labor become of service to mankind. The ultimate test of value must be usefulness. It may be that the particular orbit of an electron is more specifically defined, but any idea must be capable of being used, to have a value.

I may be pardoned, I hope, if I say that the division of chemistry and chemical technology of the National Research Council has for the past few years seen the opportunity of developing our industries in the way I have just outlined. The work is now in excellent order and will be pushed during the coming year. Our great industries have responded cordially, and some of the more important fundamental research problems have been formulated. The next step is to win the cooperation of the university men. Measures are being taken now actively to bring about the kind of cooperation which must prove fruitful in time.

A second path is before our university men who wish to devote their energies to the development of our industries. Let them work in those fields of the science which are being applied. We are producers of vast quantities of petroleum products. We have the opportunity to develop great chemical industries based on an abundant raw material. We use this possible source of untold wealth only to move from place to place. Compare what coal tar and petroleum have done to add to our joy in living. Coal tar was studied by the greatest investigators and the results obtained aroused the admiration of the world. I believe petroleum offers the same possibilities. Let American chemists center their attention on the many fascinating problems awaiting solution in this field.

By cracking the crude oil we can make hundreds of compounds valuable as sources for myriads of products that will make over our life as coal tar did. I am not suggesting that any one try to make a fortune from petroleum, but that the many scientific problems pushing forward for study be approached in the same spirit that finally led to the triumphs attained in aromatic chemistry.

There are many other fields in which America should lead in pure science. The study of carbohydrate chemistry has just begun. We are making noteworthy progress in the chemistry of the organometallic compounds and are taking a commanding position in the study of the application of chemistry in medicine.

Again I want to emphasize the fact that I do not mean that our university men should become industrialists. Let some of them work in these fields that are being applied so successfully. Everything they do will be recognized and used. The most striking thing in applied science to-day is the quickness with which the results of academic research are utilized. Twenty-five years passed before any one made use of Faraday's epoch-making discovery of benzene. It would not be so to-day.

I have had nothing to say of the kind of research that changes the trend of the investigation into the unknown. This is logical because I have been speaking of the type of research that is more or less directed. No one would want the whole world to follow on the paths I have indicated. There are always geniuses who go their own way; unfortunately these are but few. We do not attempt to point the road. They should be provided with every material aid, and that is a part of the plan.

I have outlined in a somewhat discursory way how it appears to me chemistry can be made in the future a more vital factor in America. It all goes back to research. The industries should seek more fully than in the past the cooperation of individual academic investigators in solving their industrial problems. The industries should point out to the chemical world the fundamental unsolved problems underlying their procedures.

Many of our investigators should turn their attention to developing the pure chemistry of the fields upon which our industries are based. The investigator of genius should be encouraged to push his way into the great unknown and should be provided with ample resources for his work.

How can our society help to bring all these things about and how can it in perhaps more efficient ways encourage and support research? I said some of us had been dreaming dreams—daytime dreams. We see the fully developed rose in the tiny bud. The bud is the endowment fund, and it lies next to our hearts. I dream of the day when the society will be supplied with adequate resources to take such a place in aiding research that we shall be the envy of the scientific world. We have just made a start. We must have the cooperation of every one of our members. Each one must feel a personal interest in the success of the effort being made. Each one must see it from an altruistic point of view and at the same time recognize the fact that the development of American chemistry reflects itself on him individually. The dignity of the profession has markedly advanced in the opinion of the man in the street and the employer.

The results up to the present have been encouraging, but much remains to be done. Has each man done what his own conscience dictates? Have you been as generous to your science as to your religion? Think it over.

The large sum of money required to foster research as it should be can not be raised from our own membership. We are not rich, but can afford to do a great deal. But after we have done our best another path lies before us. We must go to the public, especially the men who have amassed wealth as a result of the work of the chemist and tell them the story of their fortunes. We want to say that our society to the last member has done its best. We want to tell the banker, the merchant that his life and happiness have been largely enriched by the chemist.

We can tell the story of chemistry in a way that many will understand, and I am confident of a favorable outcome. We must and we shall win.

As you go to your homes, spend a few minutes in the way I have spent hours. Think what you would do if you had a great sum to devote to the development of chemistry. Draw up a plan, so much for this, so much for that. I guarantee that if you are an optimist, and God help you if you are not, you will be full of enthusiasm and go home determined to wake up your associates to the beauty of the idea underlying our endowment fund.

Don't leave all the delights of achievement to others. Those of us who are steering the ship have an eye fixed on the star. Join the crew and be ready to cheer when we sail into port.

JAMES F. NORRIS

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

THE TWILIGHT ZONE OF MATTER[1]

WHEN we crush and grind the ordinary coarse matter which we can see and handle, we can break it up into smaller and smaller particles. At first these particles can still be seen by the unaided eye, but as the process of grinding is continued, they become so small that they can be distinguished only with the help of a lens or of a microscope. One can carry the process of subdivision of matter still further, so that the particles become too small to be seen even with the aid of the most powerful microscope, and finally

[1] Address delivered before the seventieth meeting of the American Chemical Society, Los Angeles, August 3, 1925.

reaches the ultimate limit of subdivision, the molecule, beyond which farther subdivision is impossible without destroying the chemical nature of the substance.

Since the smallest particle of matter directly visible under the microscope is perhaps about a thousand times larger than the simplest molecule, a considerable range of subdivision of matter lies between the limits of the microscopically visible and the molecular states; and it is to this intermediate zone that I have ventured to apply the term the "twilight zone of matter."

It is to this range of subdivision of matter that, in more scientific language, the term "colloidal state" of matter is applied.

Not only does matter in the twilight zone of subdivision present many problems of peculiar fascination to the seeker after a fuller knowledge of natural phenomena, but the important rôle which colloidal matter plays in almost all the diverse fields of human activity appeals also to the man of more practical instincts. In agriculture and in the tanning of leather, in the working of clay for the manufacture of the common brick or for the production of the finest porcelain, in the production of artificial silk and of smokeless ammunition, in the dyeing of textile fibers and in the production of the blue of the sky or the blue of the eye, the colloidal state of matter plays a part.

When, further, we recall that nature has selected matter in the colloidal state to be the vehicle of life and as the medium in which all life processes take place, the importance and interest of a study of the twilight zone of matter become obvious.

It was the Scottish chemist, Graham, who first discovered a useful method of distinguishing between the molecular state of subdivision and the state of subdivision known as colloidal.

Certain substances in solution were found to diffuse through parchment paper or animal membrane, whereas other substances could not do so; and since the substances which did not diffuse through parchment paper were thought to be non-crystallizable and of the nature of gelatin, glue and similar materials, Graham called them colloids, from the Greek word for glue.

Substances that diffused through parchment paper and existed in solution in the molecular state of subdivision—sugar and salt, for example—were called crystalloids. Although we recognize the imperfections of Graham's classification, his distinction is of considerable practical importance, for the process of dialysis, discovered by him, gave a means of distinguishing between molecularly dispersed matter and matter in the so-called colloidal state.

Since the peculiar and characteristic properties of the twilight zone of matter do not depend on the physical state of the finely subdivided matter or of the medium in which the matter is dispersed, we shall find the colloidal properties exhibited not only by colloidal suspensions or emulsions, where we have solid particles or liquid droplets dispersed in a liquid medium, but by smokes (solid particles in a gaseous medium), mists (liquid droplets in a gaseous medium), forms (gas bubbles in a liquid) and so on.

Whereas it could be inferred from the experiments of Graham that the colloidal systems, although apparently homogeneous like a solution of sugar, are nevertheless heterogeneous and contain particles which have a magnitude greater than molecular, the actual existence of such particles has been rendered evident by the scattering of light by these particles and the so-called Tyndall effect—and the introduction of the ultra-microscope by Siendentopff and Zsigmondy has enabled the eye to detect the presence of particles of a magnitude of about six millionths of a millimeter, which is about sixty times the dimensions of a hydrogen molecule. By the use of ultra-violet light and a photographic plate instead of the eye, particles of still smaller dimensions can be detected. This fact has proved of great value in biochemistry in the examination of filterable viruses, as in the case of the virus of cancer, according to recent announcements from London.

In the scattering of light by finely divided particles, it is mainly the light of shorter wave length that is scattered and the light reaching the eye is therefore blue. The very fine smoke rising from a wood fire, for example, when illuminated from the side and viewed against a dark background appears blue, but when viewed against a background of white cloud, that is, by the transmitted light, the smoke appears reddish brown in color.

In the same way, as Leonardo da Vinci suggested long ago, one may explain the blueness of the sky by the scattering of the sunlight by finely dispersed particles in the atmosphere (or, as is now thought, by the molecules of the atmospheric gases themselves), the background being the blackness of infinite space.

The blue color of the eye and the blue colors of feathers are similarly to be explained, as Bancroft has so fully shown, by the scattering of light by finely dispersed matter.

Matter in the colloidal state is therefore matter in a very fine state of subdivision, so that the extent of surface exposed is very large compared with the total volume of the matter.

Surface forces, therefore, play a predominant part and bring about changes in the distribution or concentration of matter at the surface of the particles.

This change of concentration at a surface, brought about by surface forces, is spoken of as adsorption. We see the effect of adsorption, for example, in the removal of coloring matter from solution by charcoal. By reason of its high adsorbing power, charcoal was employed, during the great war, in the construction of gas masks for the adsorption of so-called poison gases —many of which were not gases at all, but finely subdivided solids—colloidal smokes—similarly, the recently introduced, highly porous silica gel is used for the recovery of volatile solvents, for the removal by preferential adsorption of gasoline from natural gas and for freeing crude petroleum from deleterious sulphur compounds.

In the production and characterization of colloidal systems, adsorption plays a very important part. By the adsorption of ions from the dispersion medium or from electrolytes present in the solution, the colloid particles acquire an electric charge; and adsorption of the dispersion medium as a whole may also take place to a greater or less extent whereby variation in the general behavior of colloids may be produced. In the case of the so-called suspensoid colloids or hydrophobe colloids, such as colloidal solutions of gold, or arsenous sulphide, the dispersed particles may adsorb none or practically none of the dispersion medium and they exist therefore in suspension as non-hydrated particles, the stability of which is due to their electric charge and to their Brownian movement. In the case of the so-called emulsoid or hydrophile colloids, such as solutions of gelatin or starch, the dispersion medium itself is adsorbed and the stability and properties of such a colloidal solution are due to the adsorbed water as well as to the electric charge on the particles; the greater the adsorption of the dispersion medium, the more will the stability and properties of the colloidal solution be dependent on this adsorbed medium and the less will they depend on the electric charge.

If the electric charge on a suspended colloid is neutralized, agglomeration of the particles followed by precipitation takes place, and this neutralization can readily be effected by the addition of electrolyte.

Negatively charged colloid particles will preferentially adsorb the positive ions of the added electrolyte, and positively charged colloids the negative ions, thus neutralizing the charge on the colloid. Although multivalent ions are in general, according to Hardy's rule, more effective in producing precipitation than univalent ions, recent investigation shows that there is no exact relationship between valency and precipitating power, and that the adsorbability of the ion may exercise an important influence. In the precipitation of colloidal sulphur, for example, caesium ion is a hundred times more effective than the lithium ion and has a greater precipitating power than the bivalent ions of zinc, cadmium or nickel.

The precipitation of fine particles by electrolytes is well illustrated in nature, where the finely divided clay carried by many rivers is deposited when the river water mingles with the sea, thus silting up river mouths and forming deltas.

The electrical charge on a colloid particle may be neutralized not only by the ion of an electrolyte, but also by another colloid carrying an electric charge of opposite sign. Colloids of opposite sign may mutually precipitate each other and produce adsorption complexes, as Bancroft has called them, which simulate chemical compounds.

Purple of cassius, for example, is an adsorption complex of stannic oxide and colloidal gold.

Although mutual precipitation may take place essentially as a result of adsorption, chemical reaction may later occur. As Bayliss has shown, when alumina adsorbs free congo red acid, which is blue in color, a blue precipitate is formed, but when this precipitate is suspended in water, the blue color changes to red, which is the color of the salts of Congo red.

Adsorption plays an important part in the dyeing of textiles and the staining of animal tissues. Here the negatively charged color ion of the acid dyes is predominantly adsorbed by a positively charged fiber, and a positively charged dye (basic dye) by a negatively charged fiber.

In an acid both the positive charge on the fibers is increased by adsorption of hydrogen ions and adsorption of a negative or acid dye by the fiber is increased. On the other hand, in alkaline solution, the negative charge on the fiber is increased, and adsorption of a positive or basic dye by the fiber is facilitated.

Similarly, addition of a salt giving a readily adsorbed ion, *e.g.*, sulphate ion, will both increase the adsorption of a basic dye and diminish that of an acid dye.

In the case of substantive dyes, the dye itself is in colloidal solution and addition of electrolyte, in small amount, increases the dye adsorption by diminishing the stability of the colloid.

Where mordants are used, adsorption takes place, the mordant, a colloid, adsorbing the dye from the dye bath and fixing it on the fiber. It is really the mordant that is dyed, not the fiber.

After the dye has been adsorbed, secondary changes may take place, leading to the formation of a more stable adsorption complex.

In the face of colloidal solutions of the gelatin type, the stability of the colloid is due mainly to adsorbed water or adsorbed dispersion medium, and consequently such solutions are not so sensitive to added electrolytes. Although the addition of small amounts of an electrolyte may produce changes in the amount of water adsorbed by the colloid, actual precipitation does not take place until the concentration of added electrolyte is relatively large.

The comparatively great insensitiveness to electrolytes, shown by hydrophile colloids of the gelatin type, may be transferred to hydrophobic or suspensoid colloids of the colloidal gold type.

When gelatin, for example, is added to a colloidal gold solution, the gold is adsorbed by the gelatin and a much greater concentration of electrolyte is required in order to precipitate the gold that is necessary in the absence of the gelatin. The gelatin is said to protect the gold. This so-called protective action, which varies greatly in different hydrophile colloids, is of much importance in many directions.

In the Mississippi and Nile rivers the water is always turbid and muddy, owing to the presence of a large amount of colloidal organic matter which stabilizes the fine suspension of clay and soil; and it is only when the rivers reach the salt water of the sea, with its high concentration of salts, that the finely dispersed mud is precipitated, forming deltas.

The water of the Ohio River, on the other hand, is at all times clear, owing to the absence of protective colloids and the presence of lime and other salts which act as precipitating agents.

By the use of protective colloids, sparingly soluble substances produced by chemical reaction can be kept in a colloidal state and so prevented from undergoing flocculation and sedimentation. In the production of the photographic plate, the silver bromide is prevented from forming a precipitate of coarse particles unsuitable for photographic purposes and is kept by the protective action of gelatin in a finely divided form.

In many physiological processes the protective action of hydrophile colloids may also play an important part. In normal bile, the bile salts, albuminoids, etc., act as protective colloids which keep the sparingly soluble substances, such as cholesterol and the calcium salt of bilirubin, in the colloidal state and so prevent their deposition, but when the amount of protective colloids is reduced by pathological conditions, deposition of the sparingly soluble substances, as gall stones, takes place.

The nature of the curd that separates from milk and the readiness with which it is formed are greatly affected by the presence of protective colloids. Cow's milk contains a large amount of casein and a small amount of the protective colloid, lactalbumin. It, therefore, curdles readily. In human milk there is a smaller proportion of casein and a larger proportion of lactalbumin, so that the casein is more effectively protected and curdling takes place less readily. In asses' milk the relative proportion of protective colloid is highest of all, and curdling takes place with greatest difficulty. The digestibility of asses' milk is consequently greatest. By increasing the amount of protective colloid in cow's milk, by addition of gelatin or white of egg or even of barley water (starch) curdling occurs less readily and the digestibility of the milk is increased.

The smoothness of a good ice cream also is due to protective colloids, such as gelatin or white of egg, which prevent the coagulation of the casein and keep the crystals of ice extremely small.

Many colloids of the hydrophile type, *e.g.*, gelatin, fibrin, etc., when cooled, pass into a jelly, owing to a coalescence of the hydrated colloid particles. This jelly may be dried and is then obtained as a more or less hornlike material, such as ordinary dry gelatin. These jellies have the important property of taking up or imbibing water, even against very great pressures. This imbibing power is of great biological and agricultural importance. The amount of water imbibed is greatly affected by the presence of electrolytes, being increased by acids and alkalies up to a certain concentration, but the increased swelling produced by dilute acids is diminished by the addition of salts.

The protoplasm of the cells, as has been demonstrated by Gaidukov and by Price, consists of a mixture of colloids. In the cell we have a complex emulsion which under the changing conditions of life may vary in consistency from that of a colloidal solution to that of colloidal gel or jelly. In this system there occur processes of adsorption, changes in dispersity and alterations of the distribution of water between the colloidal particles and the dispersion medium. The living protoplasm, indeed, is a complex system of colloids between which the mutual relations are in a constant state of flux under the action of electrolytes and of stimuli of different kinds; and in which the mass law relationships are altered, now in this direction, now in that, enabling the processes of decomposition and of synthesis to take place. Only in such a colloid system is it possible to have the flexibility and adaptability to the varying requirements of what we call life and growth; just as gelatin, fibrin and other colloids can imbibe and hold large quantities of water, so it is possible for the living organism, aided no doubt by osmotic forces and the

presence of membranes of a semi-permeable character, to hold the 80 per cent. of water present in the body tissues and to preserve the turgor necessary for healthy life. Moreover, the many diverse chemical reactions involved in the breaking down of complex foodstuffs into simple substances and the building up again of these simple compounds into the complex proteins of the protoplasm are accomplished in the living body under the catalytic activity of the enzymes, and these are themselves colloids.

The living organism, therefore, is a vast colloidal community, the diverse members of which are held together in common service by surface forces and by the mutual actions and reactions of electrical changes, and in this community the colloidal workers are engaged in carrying out the multifarious and complex chemical operations on which the life and the health of the community depend.

Martin Fischer has emphasized, perhaps over-emphasized, the analogy between the inhibition of water by gelatin and the water absorbing and retaining power of the colloids of the living organism as affected by variations in the concentration of electrolytes and especially of acids. That work is of great interest and importance, but I wish here to refer more especially to the work of Bancroft and of Clowes on emulsions as affording a suggestive explanation of the action of the plasmatic membrane of cells.

One of the most interesting phenomena in connection with the action of electrolytes on living cells is the so-called antagonistic action of ions. The beat of a heart, for example, continuously perfused with a solution of sodium chloride, isotonic with the blood, soon ceases, but the "toxic" action of the sodium ions can be counteracted by the addition of a small amount of a calcium salt. Similarly, as Loeb showed, the marine organism *Fundulus* dies when placed in a solution of sodium chloride of the same osmotic pressure as sea water, and it dies also in a solution of calcium chloride. In a mixed solution of these two salts, however, containing the salts in the ratio of about fifty molecules of sodium chloride to one molecule of calcium chloride, the organism continues to live. Since, as Straub has shown, the effect of electrolytes is an effect on the cell membrane, it is to the latter effect that we may turn our attention.

The protoplasm of the living cell is surrounded by a membrane or surface layer which allows the passage of certain dissolved substances but prevents the passage of others. Although in some respects this plasmatic membrane is similar to the artificial semi-permeable membrane, like copper ferrocyanide, experiment shows that very important differences exist. The membrane of the living cell, as Nägeli has shown, is self-forming, and it differs also from the inorganic semi-permeable membranes in that its permeability may vary and that it is adaptable to the varying requirements of an everchanging life process. While the cell is resting, for example, the plasmatic membrane is impermeable to glucose and the amino-acids, but when the cell passes into a state of functional activity, these substances can pass through the membrane.

The permeability of the plasmatic membrane is also variously affected by different ions. Frog's muscle, for example, placed in an isotonic solution of potassium chloride, is permeable to potassium ions. When, however, sodium and calcium salts, which are normally present in blood plasma, are added, the normal impermeability of the muscle cells to potassium is regained. Although the resting muscle cell is impermeable to potassium salts, the active muscle cell is permeable.

The plasmatic or cell membrane is a surface film or layer comparable with the layer of increased concentration which forms at the boundary surface of a solution when the surface tension of the solvent is lowered by the solute (*e.g.*, solutions of peptone). The materials forming the plasmatic membrane must be drawn therefore from the constituents of the cell, more especially lipoids. Various views have been put forward to explain the selective permeability of the cell membrane, in view of the variability of the cell membrane under different conditions, and more especially of the antagonistic action of ions on the permeability, much interest attaches to the work and suggestions of Bancroft and of Clowes.

When water and olive oil, for example, are shaken vigorously together, the oil is broken up into drops. These drops are comparatively large and no permanent emulsion is formed. In order that the droplets of oil may become sufficiently finely divided and a permanent colloidal emulsion obtained, an emulsifying agent must be added to break up the drops and prevent them from coalescing.

Bancroft has shown that a water solution of a sodium soap has a lower surface tension than when the soap is dissolved in oil, and that when a mixture of oil and aqueous soap solution is shaken, an emulsion of oil in water is formed. On the other hand, the surface tension of a solution of a calcium soap in water is greater than in oil, and therefore an emulsion of water in oil is formed. In the first case the water is the continuous phase, while in the second the oil is the continuous phase.

The reversal of an oil-in-water emulsion to a water-in-oil emulsion can be effected by different salts. Alkali salts, for example, favor the formation of oil-in-water emulsions, while calcium salts favor the formation of water-in-oil emulsions. Here again we have

the same antagonistic action of ions as in the case of heart muscle. Similarly, blood plasma may be regarded as an emulsion of fibrinogen and other colloids in an aqueous medium, and the blood clot an emulsion of water in fibrin. The production of the latter system is favored by calcium salts, but is retarded by sodium salts.

Clowes has shown that there is a very close resemblance between the effects produced in emulsions of oil and water and those produced in biological systems, and he has made the valuable suggestion that the cell membrane is a system, a colloidal emulsion, of two phases; a watery solution of protein and a lipoid phase. In the resting state of the cell the membrane consists of an emulsion of protein solution in lipoid, the latter being the continuous phase. In this state, therefore, the membrane will be permeable only to the substances that are lipoid-soluble. In the active state of the cell, there is a reversal of the emulsion, and the aqueous phase becomes the continuous one. In this case, substances soluble in water will now be able to pass through. In each instance, however, regarding the emulsion-membrane as a sieve, the membrane will be permeable only to those substances the particles or molecules of which are small enough to pass through the "pores" between the droplets of the dispersed phase.

We can thus regard not only the protoplasmic cell contents but also the surface layer or cell membrane as a colloid system, and by adopting the view, probably not complete in itself, that the cell membrane is a complex emulsion of colloids, the two phases of which are capable of undergoing reversal, we can explain many of the phenomena associated with the action of the cell membrane.

Although we must recognize the essential importance of colloidal matter in connection with the phenomena of life, and matter in the colloidal state is the vehicle of life; although, further, we may interpret much of the behavior of living matter in terms of physics and chemistry, I am of the opinion that we can not explain life itself in terms of physical science. There seems to be no continuity between inanimate colloidal matter and living matter, but there is a distinct and sharp break in the curve of relations. In other words, life is a new factor, a new set of potentialities, introduced into inanimate matter. Life is a new creation.

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WALTER SCOTT HENDRIXSON

ON July 1, Professor Walter Scott Hendrixson was found dead in his summer cottage at Portage Point, near Manistee, Michigan, where he had been temporarily alone. Death had occurred suddenly from hemorrhage in the brain.

Professor Hendrixson was born in Ohio in 1859; was graduated from Union Central College, Meron, Indiana, in 1881; was instructor and later professor of physics and chemistry at Antioch College, 1882–8; assistant and graduate student in chemistry at Harvard 1888–90, receiving the degrees of A.M. in 1889 and Ph.D. in 1903. He came to Grinnell College as professor of chemistry on the Dodge foundation in 1890, and at the time of his death was the senior member of the Grinnell College faculty, yet a most active and aggressive member and a valued adviser in affairs of the college.

During leaves of absence from Grinnell he had spent one year as graduate student at Goettingen and Berlin; one semester as lecturer in chemistry at the University of Illinois; a year as research fellow at Johns Hopkins University. He was a frequent contributor to the *Journal* of the American Chemical Society; was a member of learned societies; had served as president of the Iowa Academy of Sciences.

As a teacher, Professor Hendrixson was an inspiration to his students, sending many of them on to graduate and professional work in chemistry. As a chemist, the work of his earlier years was with water analyses and in the investigations of artesian waters underlying Iowa, by the United States Geological Survey. In his later years he has been a regular contributor in the development and applications of electrometric methods in chemistry, his last publication bearing date of May 5, 1925.

As a fitting and permanent memorial of a long and distinguished service, Professor H. W. Norris, a colleague of more than thirty years, has proposed the establishment of the Walter Scott Hendrixson Memorial Fund, for the promotion of research in pure science by members of the faculty of Grinnell College; a fund, the income of which is to be used for the promotion of research by paying the actual expenses involved in original investigations. The aptness of this suggestion was immediately recognized and measures promptly taken looking toward securing an endowment of not less than $10,000 for such a memorial.

FRANK F. ALMY

SCIENTIFIC EVENTS

RESEARCH AND INDUSTRY IN GREAT BRITAIN

THE British Science Guild have published a report, by the Research and Inventions Committee of the Guild, on the present position with regard to the supply of trained scientific research workers, and their utilization in industry.

The committee find according to a report in the London *Times* that, comparing the year 1923–24 with the year 1913–14, the number of full-time students in science at the British universities shows an increase of 60 per cent., while the number of bachelor degrees obtained in science has more than trebled. Over the same period, the number of full-time, post-graduate students engaged in scientific research has increased to more than four times the 1913–14 figure. The Department of Scientific and Industrial Research, the committee observe, have afforded great assistance to research students in training, but, except in one or two instances, the Research Associations of the department do not appear to be very extensively developed.

The funds at the disposal of the department are large, but in view of the sums annually spent on scientific research in the United States, and our general public expenditure, they can not, in the opinion of the committee, be described as adequate to the great needs of our industries. It appears from inquiries that there is considerable unemployment among recently trained scientific research workers, and that this is most serious in the case of research chemists.

The committee conclude that the value of scientific research to industry is now widely recognized; but that the part that industry itself can play in maintaining an adequate supply of research workers, and in promoting or supporting scientific research, is not so well understood. They suggest that the government could offer considerable inducement to commercial firms to support research, by permitting sums devoted to this purpose to be treated as trade expenses for the purpose of assessment for taxation. They consider it imperative that, before more men and women are encouraged to undertake scientific research training, the demand for them should first be assured. The committee do not look to the greater industrial concerns—many of which already realize to the full the value of scientific research—to provide a solution of the present difficulty, but rather to the hundreds of smaller firms whose industrial research associations, if fully developed, could utilize many more scientific research workers; to the benefit, the committee submit, not only of each particular industry, but of the industry of the country as a whole.

The committee further suggest an extension of the method adopted by the various research committees and coordinating boards of the Department of Scientific and Industrial Research, and by the Ministry of Agriculture and other Departments; a inquiry with a view to the establishment of an organization on the lines of the "A. D. Little" Laboratories in the United States; and also an extension of the scheme at present in operation in Bristol University, under which an industrial firm endows for two years a research student who works on a special line of investigation in the laboratories of the university.

In a memorandum appended to the report the committee strongly recommend the formation of a permanent expert advisory committee on industrial inventions, the functions of which would be (1) to examine the claims of inventions and to decide which are of probable industrial value; and (2) to arrange for the semi-large scale, or complete commercial trial, of inventions passed by the committee.

RESULTS OF THE ASIATIC EXPEDITION OF THE AMERICAN MUSEUM

THE American Museum of Natural History has received cables from Roy Chapman Andrews, leader of the museum's third Asiatic expedition, now in Mongolian territory, giving details of the progress of the expedition. Dr. Clark Wissler has made public the following statement:

The results of the third Asiatic expedition prove the presence of early man in Asia and that is no mean achievement. It is certain that when the first try for paleolithic man in central Asia not only returns rich collections, but reveals two widely separated horizons, it is certain that the whole chapter of stone age history is to be read in Asia as well as Europe. This prospect holds out a promise for America, where there has been no clew to the direct relation of prehistoric man to the ancients of the old world.

Having found the implements which are associated with Neanderthal man in prehistoric Europe it can be safely predicted that sooner or later his bones will be found in Mongolia. The recent discovery of a Neanderthal skeleton in Palestine brings this type of fossil man one step nearer to Central Asia.

This discovery by the American Museum of Natural History adds another epoch to the prehistory of man in Asia. Andrews reports that a large collection has been made, sufficient fully to characterize the culture, and that it is parallel to the Azilian of Western Europe.

Azilian is the last of the old stone age cultures and marks the transition to the neolithic, or second great stone age. But the report goes further in stating that the finds promise to be somewhat older than the Azilian of Europe, which would put them back well within the old stone age.

We are also told that some sites examined yielded mouterian stone tools. This is a period in stone age chronology far back of the Azilian, in fact just before the appearance of the more modern types of man in Europe, or in the time of the Neanderthals.

ANNUAL MEETING OF THE AMERICAN PUBLIC HEALTH ASSOCIATION

THE fifty-fourth annual meeting of the American Public Health Association will be held in St. Louis,

Missouri, from October 19 to 22, with the Hotel Statler as headquarters. This association is the professional society of sanitarians in North America, and its annual meetings always offer a program of interest to public health workers. Several special features add more than usual interest to this year's program.

In a broad and developing field such as public health, there is danger that its diverse branches will not maintain contact with each other and with the whole. The American Public Health Association, representing as it does all public health specialities, both official and non-official, brings together at its meetings and includes in its programs the various elements, personnel and subjects that go to make up our public health structure. With a view to correlating these elements, it has this year arranged for a greater number of joint sessions and general sessions than is customary.

The association's nine sections—public health administration, laboratory, sanitary engineering, food and drugs, vital statistics, industrial hygiene, child hygiene, health education and publicity, and public health nursing—will have programs of their own consisting of one or more sessions. In addition, in a number of instances two and sometimes four sections will combine to discuss in a joint meeting some outstanding development of interest to the various groups. One subject to be discussed from four angles is the epidemiology of respiratory diseases; another is oyster pollution. There will be also five general sessions participated in by the entire association. In the twenty-seven meetings arranged for, more than one hundred and twenty-five papers and reports are scheduled. These figures do not include luncheon and dinner sessions devoted to particular topics, nor a special session on mental hygiene sponsored by the National Committee on Mental Hygiene.

The local committee on arrangements has provided an attractive program of entertainment including trips to points of general and scientific interest in and near St. Louis, free tickets to the theatre and the traditional reception following the opening meeting. The ladies are especially invited to attend and plans have been made to occupy them during the full period of the meeting.

Members of the association and their families will receive a twenty-five per cent. reduction in railroad fare traveling to and from the meeting. Non-members should make application for reduced fare to Mr. Homer N. Calver, executive secretary, American Public Health Association, 370 Seventh Avenue, New York City. The secretary will also gladly furnish additional information regarding the meeting and the program.

THE AUTUMN MEETING OF THE AMERICAN ELECTROCHEMICAL SOCIETY

THE annual fall meeting of the American Electrochemical Society will be held this year at Chattanooga, Tenn., on September 24, 25 and 26. A number of important papers will be presented by well-known authorities on electrochemical subjects.

This meeting will closely follow completion of the Wilson Dam at Muscle Shoals and the society will take the opportunity to make an inspection trip to this point as part of the program.

In and around Chattanooga there are 378 factories making 1,329 kinds of products. Cheap transportation on the Tennessee River affords easy distribution of these. The Tennessee Electric Power Company now has about 233,000 h.p. available for industries and factories and on completion of the work at Muscle Shoals much additional power will be placed at the service of the Chattanooga district. This supply of cheap power should especially stimulate the growth of the electrochemical industry in this vicinity.

During the fall meeting, headquarters of the American Electrochemical Society will be at the Signal Mountain Hotel, forty minutes' ride from the heart of the city and noted for its beautiful surroundings.

The first two days of the meeting will be taken up with the technical program. The subject of the symposium for this meeting will be "The relation of electrochemistry to the fertilizer industry." Dr. H. C. Parmelee will be in charge of this symposium. Papers will be offered on nitrates, phosphates, hydrogen, potash and other subjects. On Friday a round-table discussion will be conducted on "Electric Ferro Alloys." Mr. Robert Trumbull will be chairman.

On Saturday, September 26, members and guests will spend the entire day at Muscle Shoals. This will afford an unusually fine opportunity to inspect America's largest dam, a development of immense interest to the electrochemical industry. A further program of visits among the local industries and nearby places of interest has been arranged by the local committee, of which Mr. Paul J. Kruesi is chairman.

RESEARCH FELLOWS AT THE CARNEGIE INSTITUTE OF TECHNOLOGY

EIGHT appointments as research fellows and one as research engineer have been made to conduct investigations of problems in mining and metallurgy this coming year in cooperation with the U. S. Bureau of Mines, according to an announcement from the Carnegie Institute of Technology.

The appointees to mining fellowships are: Russell B. Cooper, Johnstown, Pa., University of Pennsyl-

vania; Charles O. Hawk, Felicity, Ohio, Ohio University; Garnet Phillips, Terre Haute, Ind., Rose Polytechnic Institute; Ben E. Hess, Huntington Park, Cal., California Institute of Technology; and H. F. McCullough, Scottdale, Pa., special appointment as research engineer.

The following were named as research fellows in metallurgy: Abraham Grodner, Pittsburgh, Pa., Carnegie Institute of Technology; Ralph B. Norton, Eastondale, Mass., Massachusetts Institute of Technology; Gustave H. Pfeiffer, Terre Haute, Ind., Rose Polytechnic Institute; and E. A. Hertzell, Schuylkill Haven, Pa., Pennsylvania State College.

The research program in mining and metallurgy at the Carnegie Institute for the next college year is announced as a continuation of the cooperative arrangements that have been in effect with the Bureau of Mines in mining for the past five years and in metallurgy for the past two years. Two different advisory boards, composed of coal operators and engineers in the one case, and of steel manufacturers, engineers and metallurgists in the other, have approved the problems to be investigated, and will cooperate financially in carrying out the program.

Problems selected in mining have been assigned as follows:

The composition of tar and oil from the low temperature distillation of coal, by R. L. Brown, organic chemist, Bureau of Mines, and Russell B. Cooper, research fellow.

Study of simple catalytic attachments to electric cap lamps for detecting methane, by W. P. Yant, associate chemist, Bureau of Mines, and Charles O. Hawk, research fellow.

Time-pressure relations in combustion of the fine sizes of coal-dust, by C. M. Bouton, associate research chemist, and Garnet Phillips, research fellow.

A study of the propagation of flame in mixtures of natural gas and air, by H. F. Coward, principal assistant, Safety in Mines Research Board, England; G. W. Jones, associate chemical technologist, Bureau of Mines, and Ben E. Hess, research fellow.

A field study of underground coal-loading machines and mining methods adaptable, by J. W. Paul, mining engineer, Bureau of Mines, and H. F. McCullough, research engineer.

Assignments of the studies in metallurgy are announced as follows:

A study of the cause and control of abnormality of case carburized steels, by C. E. Sims, electrometallurgist, Bureau of Mines, and Ralph B. Norton, research fellow.

A study of the open hearth steel furnace atmosphere in relation to its effect upon refractories, by Frederick W. Schroeder, assistant chemist, Bureau of Mines, and Gustave H. Pfeiffer, research fellow.

A study of the mechanism of corrosion and the factors effective in its control in steam power plant operation, by R. E. Hall, physical chemist, Bureau of Mines, and E. A. Hertzell, research fellow.

Temperature and heat-flow studies in open hearth and electric steel furnaces, by B. M. Larsen, metallurgist, Bureau of Mines, and Abraham Grodner, research fellow.

SCIENTIFIC NOTES AND NEWS

AT the annual meeting of the British Medical Association held at Bath, Dr. Robert George Hogarth was elected president for 1926–27. It was agreed that the annual meeting in 1927 be held in Edinburgh and be part of the Lister centenary celebration.

SIR CHARLES S. SHERRINGTON, president of the Royal Society and Waynflete professor of physiology in the University of Oxford, has been appointed a member of the Medical Research Council, England, to fill the vacancy caused by the retirement of Dr. Henry Head, F.R.S.

THE Baly medal of the Royal College of Physicians of London has been awarded to Dr. R. Magnus, professor of pharmacology at Utrecht.

THE Alfred Ackermann-Teubner Memorial Prize for the promotion of the mathematical sciences has been awarded to Dr. Arnold Kohlschütter, of the Astrophysical Observatory at Potsdam, for his determination of the absolute brightness of stars from the intensity relations of certain spectral lines.

THE Royal Belgian Academy has awarded its decennial prize for applied mathematics for the period 1913–1922 to Professor T. de Donder, for his works on the Einstein theory of gravitation and his "Leçons Thermodynamiques êt de Chimie Physique."

M. GAILLARD, director of the Museum of Natural History at Lyons, has been made chevalier of the Legion of Honor.

WE learn from *Nature* that at a meeting of the Vienna Academy of Sciences on June 12, Dr. Oswald Redlich was reelected president, and Dr. Richard Wettstein vice-president. Dr. William Exner, of Vienna, and Dr. Waldemar Chr. Brögger, of Oslo, were made honorary members. Dr. Niels Bohr, of Copenhagen, Dr. Max von Laue, of Berlin, and Dr. Eugen Korschelt, of Marburg, have been elected foreign corresponding members. The following awards were made: the Lieben prize to Dr. L. Meitner for publications on β and γ rays of radioactive substances; the Haitinger prize to Dr. R. Kremann for work on the electrolysis of metal alloys, and also to Dr. L. Moser for work on quantitative analysis and the purification of gases.

DR. HENRY C. TAYLOR, chief of the Bureau of Agricultural Economics of the U. S. Department of Agriculture, has resigned at the request of Secretary Jardine. Thomas P. Cooper, dean of the Agricultural College of the University of Kentucky, has been chosen to succeed him.

PROFESSOR A. R. LAMB, chief in nutrition at the Iowa Agricultural Experiment Station, has resigned to accept the position of director of research for the Moorman Manufacturing Company, Quincy, Ill.

S. P. KINNEY has been designated supervising metallurgist of the Bureau of Mines, with headquarters at Pittsburgh, Pa.

WILSON POPENOE, for the past twelve years an agricultural explorer for the United States Department of Agriculture, will leave the government service on October 1 to go with the United Fruit Company, as an investigator of horticultural problems.

GLENN E. PAXTON, assistant in plant pathology and graduate student at the University of California, has accepted a position as plant pathologist of the Fuerte Valley Vegetable Growers' Experiment Station of Los Mochis, Sinaloa, Mexico, of which Dr. A. W. Morrill, of Los Angeles, California, is director and entomologist.

THE vice-chancellor of the University of Cambridge has nominated Arthur Lourie, B.A., LL.B., scholar of St. John's, to hold the Choate Memorial Fellowship at Harvard University for the year 1925–26, in the place of Dr. W. H. B. Twamley, of Emmanuel, who resigned the fellowship on his election to a Laura Spelman Rockefeller Memorial Fellowship.

MADAM A. P. RAKITZKAIA, an assistant to Professor Omeliansky, of the Institute of Experimental Medicine, Leningrad, Russia, has been granted a fellowship by the International Education Board in order that she might carry on the study of soil microbiology at Rutgers University and the New Jersey Agricultural Experiment Station at New Brunswick.

THE Highway Research Board of the National Research Council has started a new investigation on culvert pipe with R. W. Crum, engineer of materials and tests, Iowa State Highway Commission, chairman of the investigation.

DR. SPENCER L. DAWES, medical examiner of the New York State Hospital Commission and president of the Interstate Conference on Immigration, has sailed for England to make a study of the examination of British immigrants under the method advocated by Secretary of Labor Davis.

AT the meeting of the senate of the Queen's University, Belfast, held on July 15, a tender was accepted for the erection of buildings for the department of agriculture. It is hoped that these buildings will be completed in about 18 months at a cost of £46,000. Of this sum, £34,500 has been given by the Ministry of Agriculture for Northern Ireland, £5,000 was contributed by the late Miss Riddell and £6,000 was provided from general university funds.

PROFESSOR H. E. ROSE, of the dairy department of the State College of Agriculture at Cornell University, sailed with his family for South America on August 15. Professor Rose has been asked by the Argentine government to investigate and report on dairy conditions in the Argentine.

THE Rothamsted Experimental Station, at Harpenden, England, and the New Jersey Agricultural Experiment Station, New Brunswick, N. J., have entered into an exchange whereby Mr. H. Sandon, assistant protozoologist of the Rothamsted Station, and Dr. Charles E. Skinner, assistant microbiologist of the New Jersey Station, are to go to New Brunswick and Harpenden, respectively. A cooperative study has been planned whereby the two institutions may be able to determine definitely to what extent soil protozoa are a major factor in soil fertility. The undertaking is being financed by the International Education Board.

PROFESSOR C. H. KAUFFMAN, of the department of botany of the University of Michigan, has been granted sabbatical leave for the first semester of the school year 1925–26, and expects to devote that period to field study in the Pacific coast states.

DR. WALTER R. MILES, professor of psychology at Stanford University, will be special lecturer in psychology at the University of California for the first semester 1925–26, in the absence of Dr. G. M. Stratton.

DR. FRIDTJOF NANSEN, the Arctic explorer, will head the Norwegian delegation to the forthcoming meeting of the Assembly of the League of Nations.

CAPTAIN GEORGE WILKINS, British polar explorer, has been in Norway preparing for an expedition next year into the Antarctic, where he proposes to explore and survey the coast between Whale Bay and Graham's Land. Captain Wilkins spent four years in the Arctic with Stefansson and two years in the Antarctic with Shackleton. He has negotiated with the Norse Aero Club for the purchase of Amundsen's airplane N-25 for $20,000, for use in exploration flights in the Antarctic.

AT the summer meeting of the American Mathe-

matical Society at Cornell University, from September 8 to 12, the tenth colloquium of the society will consist of two courses of lectures: "The new differential geometry," by Professor L. P. Eisenhart; and "The theory of approximation," by Professor Dunham Jackson.

SIR JOHN ROSE BRADFORD has been appointed to give the Harveian Oration of the Royal College of Physicians of London in 1926.

IT is announced that on account of unforeseen circumstances the Lane Medical Lectures which are to be given by Professor Vittorio Putti, of the Rizzoli Institute, will be postponed until November 9, instead of being delivered during the second week of October as was originally planned.

JOHN H. SAGE, banker and known for his publications on the birds of Connecticut, for more than twenty years secretary of the American Ornithologists' Union, died on August 16, at the age of seventy-eight years.

A. B. SKINNER was killed on August 17 in an automobile accident while collecting Indian relics for the Heye Foundation of New York. Mr. Skinner, who at the time of his death was thirty-nine years of age, had previously been assistant anthropologist in the American Museum of Natural History and more recently assistant curator of the Milwaukee Public Museum.

DR. E. J. MCWEENEY, professor of pathology and bacteriology, at University College, Dublin, has died, aged sixty-one years.

THE death recently occurred of Professor Dr. Ing. Otto Lummer, for many years director of the Physical Institute of the University of Breslau.

THE western Christmas meeting of the American Mathematical Society and the meeting of the Southwestern Section of the society will be held at Kansas City, in conjunction with the meeting of the American Association for the Advancement of Science. At the time of these meetings, Professor James Pierpont will deliver the annual Gibbs lecture, on the topic "Some modern views of space." It is planned to hold the ordinary meeting on Tuesday, December 29, to have a joint session with the Mathematical Association and with Section A on Wednesday morning, and to have the Gibbs lecture presented before a general session of the American Association on Wednesday afternoon. The ordinary meeting of the Mathematical Association will probably fall on Thursday.

DEFINITE plans are being made for the holding of the First International Congress of Soil Science at Washington, D. C., in early June, 1927. The American Organizing Committee consists of: F. J. Alway, University of Minnesota; F. E. Bear, Ohio State University; G. S. Fraps, Agricultural and Mechanical College, Texas; R. Harcourt, Ontario Agricultural College, Guelph; S. B. Haskell, Massachusetts Agricultural College, Amherst; D. R. Hoagland, University of California; T. L. Lyon, Cornell University; C. F. Marbut, U. S. Department of Agriculture; A. G. McCall, University of Maryland; W. H. McIntire, University of Tennessee; M. F. Miller, University of Missouri; F. T. Shutt, Dominion Experimental Farm, Ottawa; F. A. Wyatt, College of Agriculture, Edmonton, Alberta; Jacob G. Lipman, chairman of the New Jersey Agricultural College and Experimental Station, New Brunswick.

THE *Journal* of the American Medical Association states that at the twenty-first annual meeting of the American Society of Tropical Medicine in Washington, Dr. Aldo Castellani, professor in the London School of Tropical Medicine, London, among others, presented a paper on "Parenteric fevers"; Dr. R. Kawamura, of the Niigata Medical University of Japan, on "Japanese river fever"; Dr. Raymond E. Scott, U. S. Army, on "Black madura foot"; Dr. Richard P. Strong, Boston, on "Medical results of the Amazon expedition in 1924," and Dr. Henry J. Nichols, U. S. Army, on "A note on cross-immunization in syphilis and yaws." Dr. Henry R. Carter was elected honorary president; Dr. Joseph F. Siler, U. S. Army, president; Drs. George C. Shattuck and Charles S. Butler, vice presidents; Dr. Brayton H. Ransom, secretary-treasurer; Dr. William E. Deeks, councilor for five years, and Dr. Henry J. Nichols, editor. Dr. Nichols reported that the editorship of the *American Journal of Tropical Medicine* should be "a full-time matter" and that the present plan is regarded as temporary until better arrangements can be made.

THE twelfth annual Congress of Hygiene will be held at the Institut Pasteur, Paris, under the presidency of Dr. Faivre, from October 19 to 23, when, according to the *British Medical Journal*, the following subjects will be discussed: (1) Is syphilis tending to disappear? introduced by Professor Pautrier, of Strasbourg; (2) standardization of the methods of bacteriological analysis of water, introduced by Dr. Rochaux, of Lyons; (3) epidemiology, geographical distribution and prophylaxis of undulant fever, introduced by Dr. Burnet, of the Institut Pasteur, Tunis; (4) experimental hygiene and laboratory research, introduced by Dr. Dujarric de la Rivière; (5) general and social hygiene, introduced by Drs. Ott and Brian; (6) sanitary hygiene, introduced by Dr. Dequidt.

AT the concluding meeting of the Esperanto Congress at Geneva, it was decided to hold the congress in Edinburgh next year.

AT a meeting attended by Dr. Gunn, director of the European Mission of the Rockefeller Institute, Professor Brumpt, member of the Académie de Médecine, and Dr. Sari, senator of Corsica, it was decided to found a malaria research laboratory at Bastia (Corsica). The expenses will be defrayed by the Rockefeller Institute.

AN additional Peruvian experiment station has been established at Chuquibamba, north of Juliaca, at an altitude of 12,500 feet, with Colonel Stordy as director. The farm or ranch contains about 18,000 acres and is stocked with about 15,000 sheep and provided with modern equipment.

UNIVERSITY AND EDUCATIONAL NOTES

DR. MAX MASON, professor of mathematical physics in the University of Wisconsin, has been elected president of the University of Chicago, succeeding the late Dr. Ernest Dewitt Burton.

THE state legislature of Tennessee has this year appropriated $315,000 to purchase additional lots adjoining present holdings of the university in Memphis, also $250,000 to assist in the construction of the first unit of the proposed building program; $100,000 has been donated by the citizens of Memphis also for this purpose. The first unit will be five stories high and will accommodate the departments of anatomy, physiology and chemistry. Construction work will start this summer.

THE entire property of Valparaiso University, Indiana, has passed into the hands of the Lutheran University Association, a branch of the National Lutheran Education Association. The university, which would otherwise have closed for lack of funds, will open as usual on September 28.

THE Medical School of the Middlesex Hospital, England, has received a gift of £20,000 from Mr. Thomas Robinson Ferens, of Hull, for the foundation of an Institute of Otology, to be devoted to research into the structure, functions and diseases of the ear, nose and throat.

DR. WILLIAM T. SANGER has been elected president of the Medical College of Virginia, at Richmond.

A. H. LEIDIGH, assistant director of the Texas Agricultural Station, has been appointed dean of agriculture and agronomy at the Texas Technological College, a state institution at Lubbock which is to open its doors to students next fall.

WILFRED W. SCOTT has resigned his position as associate professor of chemistry at the Colorado School of Mines to accept the professorship of analytical and industrial chemistry at the University of Southern California, Los Angeles.

E. G. MAHIN has resigned his position as professor of analytical chemistry at Purdue University to join the faculty of the University of Nôtre Dame, where he will be professor of analytical chemistry and metallurgy.

DR. AURA J. MILLER, a fellow in medicine of the National Research Council, working with Dr. Wolbach at Harvard Medical School, has accepted an appointment as assistant professor of clinical pathology at the University of Nebraska.

DR. ARTHUR JOSEPH HILL, associate professor of organic chemistry at Yale University, has been advanced to the rank of professor.

AT the Massachusetts Institute of Technology Dr. George L. Hosmer has been promoted from associate professor to professor of geodesy, and Dr. Richard G. Tyler from associate professor to professor of sanitary engineering.

PROFESSOR J. W. BEWS, of Natal University College, Pietermaritzburg, has been appointed professor of botany in Armstrong College, in the University of Durham, in succession to Professor M. C. Potter, retired.

DISCUSSION AND CORRESPONDENCE

THE CONDITION OF BIOLOGICAL LITERATURE IN PARIS

THE French government is forced, at the present moment, to the strictest economy. Since the universities and many of the scientific libraries are a property of the state, much of this economy falls upon them. France has never been exceedingly lavish upon its institutions of higher learning, and now, at a time when the value of laboratories and scientific libraries is beginning to be understood by the public at large, the unfortunate financial condition which followed the Great War causes a general retrenchment in expenditures. On the other hand, the disadvantage at which the franc finds itself upon the markets of the world renders almost impossible certain purchases which ought to be made, in the interest of science, in foreign countries with a high rate of exchange, such as the United States, Great Britain and Germany.

While this general condition doubtless is felt in all fields of science, a greater familiarity with biological literature allows me to speak with authority only on this one subject. The most important biological libraries in Paris are those of the Muséum d'Histoire

Naturelle, Faculté de Médecine, Institut Pasteur, École Normale Supérieure, and the various libraries of the laboratories of the Université de Paris and the Collège de France. Besides these rather specialized libraries there are others, such as the Bibliothèque Nationale and the Bibliothèque de l'Institut de France, which contain biological periodicals and books.

While the franc has been reduced to about one fourth of its pre-war value, the funds which these libraries receive for the purchase of books have in some cases remained the same as before the war, in others been but inadequately increased. This creates a very acute condition for these institutions. Were it not for the liberality of the Rockefeller Foundation, one could find almost no current American and English periodicals in France. As it is, the current issues of certain journals, such as the *Anatomical Record,* the Proceedings of the Society for Experimental Biology and Medicine, *Genetics,* etc., are not found at all in public libraries. Others, such as the *Biologisches Centralblatt, Archiv für mikroskopische Anatomie und Entwickelungsmechanik, Journal of Morphology and Physiology, Journal of Comparative Neurology, Quarterly Journal of Microscopical Science, Nature, Die Naturwissenschaften,* SCIENCE, etc., are found only in one or two libraries.

American scientists could do much, if they would, to alleviate this temporary curtailment of scientific literature. In many American institutions several members of the biological departments get the same journals and, after reading them, lay them aside unbound, often not to be consulted again, since those journals are kept also in the department library. If such journals were regularly sent to some library in Paris or some other part of France they would have a thousandfold value for science. Duplicates of SCIENCE, the Proceedings of the Society for Experimental Biology and Medicine, the Proceedings of the National Academy of Sciences, the Wistar journals, etc., would be most welcome. Such journals could be sent to the biological libraries of the Université de Paris (Laboratoire d'evolution des êtres organisés, Anatomie comparée, Zoologie, Biologie expérimentale, Physiologie, Botanique), to the other Parisian libraries enumerated above and to those in other university towns.

Another scheme which, however, would entail some sacrifice on the part of publishers, would be to adopt the plan recently put into practice, for *Isis,* by its eminent editor, Dr. G. Sarton. This would consist in giving special temporary low rates of subscription to countries with a low exchange. To the honor of French editors it may be said that, even under the difficult financial conditions in which they find themselves at the present time, they have adopted this plan for countries whose exchange is lower than France's, such as Roumania and other Balkan states. If such a plan were adopted in America, it would permit French libraries to subscribe to American journals, which it is impossible for them to do at present. One must remember that French journals can be had for about half the price which must be paid for corresponding American, English or German publications.

Finally, a system of exchanges could be started between American and French universities and scientific libraries. French scientists would gladly cooperate in such a scheme.

No greater good could be done to French science than to help rebuild its libraries. While the war has left almost no harmful trace on American science, French scientists are laboring under the double load of decreased personnel and very small funds. The present state of science absolutely requires international cooperation; much could be done for France by America in helping it to keep a position in which it can again produce a Lamarck, a Pasteur, a Claude Bernard.

RAOUL M. MAY,
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UNIVERSITÉ DE PARIS,
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ANALYZED SOUND

LAST year I submitted a communication under the title, "Analyzed sound in nature,"[1] consisting of a series of descriptions of musical echoes from natural sounds, such as waves and waterfalls, in which so many pitches were included as to give no impression of musical sounds when directly heard. In this communication the reports of five individuals were included. Since then similar observations have been reported in SCIENCE by Professor Yandell Henderson (September 26, 1924) and Professor C. Macfie Campbell (May 22, 1925).

This spring a report has come to my notice which seems to me of exceptional interest in connection with my own observation, included in the communication of July 4, 1924. That observation was that on July 27, 1903, while walking along the shore of the river near the middle of the Big Horn Canyon, I heard a loud howl beginning at a high pitch and ending in a low pitch, and that the howl reversed itself when I stepped back over the same ground. The howl proved to be nothing more than the roar of the river, something in my surroundings placing the notes of high pitch in one place and those of a low pitch in

[1] SCIENCE, July 4, 1924.

another. In a book entitled "Locating the Iron Trail," by Edward Gillette (Christopher Publishing House, Boston, 1925), three trips through the Big Horn Canyon are described. Besides Mr. Gillette's trip on the ice, there is the account of the trip in which my observation is mentioned (see pages 110 and 111), and the description of one of the two previous trips by boat, written by J. W. Newell. That trip was made in August, 1893. The following passages from Mr. Newell's account seem to me of great interest in connection with this problem of analyzed sound. On page 92, in the description of their passage down the river before reaching the canyon, there appears the following:

> As we approached the ferry, a group of men came down to the bank and hailed us. They had heard through the newspapers that a party of Sheridan men were out on an excursion with its itinerary including a passage through Big Horn cañon on a boat, and they wanted to know if we were "it." With the very best of intentions they warned us to turn back and abandon the proposed passage in a boat, and particularly such a boat as we had. They said it was too heavy and clumsy to be safely taken over the numerous rapids; that it would be dashed to pieces on the rocks and that we would all be drowned before we had proceeded a mile. They repeated some of the stories we had heard before leaving home, and told of unearthly noises that were reported to have come out of the cañon on the wings of the wind—howls and screams which made the hair stand on end—and could have emanated from no human being or animal known to exist at that day and age of the world.
>
> One of them was sure that some supernatural beings or forces which nothing human could withstand would be encountered in the depths of the cañon, and that if we persisted in going we would never be heard of again. He kindly volunteered to inform our folks at home of the day and date of our passing in case we never came out. Later we imagined we could explain the sounds that had been heard, as being produced by perfectly natural causes.

On pages 95 and 96, apropos of shots fired at mountain sheep, there appears the following:

> Our shots echoed and reverberated from the wall on one side to the opposite wall until it seemed as though a dozen shots had been fired. . . .
>
> While the report of a rifle is so magnified in the cañon, a shot fired up the mountain side is not heard below. The unearthly sounds in the cañon which chill the blood and almost cause nervous prostration, no doubt came from the roar of the rapids being reflected by the walls of the cañon acting as a sounding board in places. The sounds are startling, being unusual, and cause one to imagine them as coming from an unknown animal of enormous size.

I had heard nothing of these early traditions and observations when in July, 1903, I heard the howl arising from the roar of the river and was therefore not on the lookout for it. It is interesting, therefore, to see that similar sounds in this canyon had created such a profound impression on early settlers and that an observation so similar to my own was recorded ten years earlier by one of the parties that traversed the canyon in a boat.

ALEXANDER FORBES
HARVARD MEDICAL SCHOOL

LOSS OF VIRULENCE IN FUNGI

THERE is a general idea among plant pathologists that many fungi lose their virulence, at least in some degree, when grown in culture. Definite and authentic cases of this phenomenon appear to be not easy to find. Burkholder[1] has recently studied a strain of Fusarium, which was originally isolated from a bean plant, and which after six years in culture had largely lost its power to infect beans. When grown for a month as a parasite on beans, it regained its old virulence. This change in physiological behavior was accompanied by certain morphological changes.

The manner in which a fungus can be so changed requires explanation. At first glance it looks like the inheritance of environmental effects. But changes due to environmental factors have been found not to be inherited in other plants, and many of us do not believe in the inheritance of acquired characteristics. Cases similar to the one noted by Burkholder have been cited by some writers in support of the idea that external influences may affect the genetic constitution of organisms. Before such evidence can be accepted careful investigations should be made of some of these cases. In an extensive series of trials the author[2] found that he was unable to affect a change in the spore characters of *Pestalozzia Guepini* by selection. More recently he has found selection within pure lines of a species of Helminthosporium equally ineffective. This indicates that the genetic constitution, of some fungi at least, is not readily affected by external factors.

As a tentative theory explaining the loss of virulence in culture, the following is proposed. Mutations have been found to occur in several species of fungi which have been carefully studied. Stevens[3] has found them in Helminthosporium, Bonar[4] in Brachysporium and the author[2] in Pestalozzia. When a fungus, normally parasitic, is grown as a sapro-

[1] *Amer. Jour. Bot.*, 12: 245–253, 1925.
[2] *Genetics*, 7: 142–201, 1922.
[3] *Bull.* Ill. Nat. Hist. Survey, 14: Art. 5, 1922.
[4] *Amer. Jour. Bot.*, 11: 123–157, 1924.

phyte, mutations occur which give rise to saprophytic strains. These will thrive while more actively parasitic strains will tend to die out, and loss of infecting power of the culture will occur. When again grown as a parasite, the fungus will regain its virulence, through the development of parasitic strains which originate as mutations, while the saprophytic strains will perish. It may be expected that different organisms will vary greatly in the time required to lose, and regain virulence depending on the frequency of mutation in the species. In some forms, loss of virulence does not occur. Dr. Erwin F. Smith reports a potato rotting organism which is as virulent, after eighteen years in culture, as it was when first isolated.

The proposed theory likewise may prove an explanation of attenuation in bacteria.

At present none of the sudden changes observed in fungi has been studied cytologically, so we do not know whether or not they are capable of explanation on a basis of chromosome behavior. For convenience they are therefore called *mutations*.

The author proposes to investigate known cases of loss of virulence and to test the above theory. He is especially anxious to hear from those who know of well-substantiated occurrences of this phenomenon.

CARL D. LARUE

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SPONGILLA LACUSTRIS IN MASSACHUSETTS: A CORRECTION

IN a recent note[1] to SCIENCE, we described the occurrence of the fresh-water sponge, *Spongilla lacustris* Linn., from the Sudbury River near Concord, Massachusetts. Since then Professor Ira Remsen has called our attention to the fact that his study of the water supply of Boston in 1881 revealed the presence of a sponge, which was at that time identified by Professor W. G. Farlow as *Spongilla fluviatilis* Auct. Although there are no descriptions of spicules, gemmules or habits of growth in his report,[2] a colored plate gives conclusive evidence to our minds that he was dealing with the same sponge as the one we described. Further evidence of the identity of the two sponges may be the occurrence of the peculiar "cucumber" odor associated with both.

Revisions in sponge taxonomy since 1881 have restricted the name "fluviatilis" to the genus, Ephydata, formerly called Meyenia by Carter, so that there is no longer any confusion between *Ephydata fluviatilis* and *Spongilla lacustris*, due chiefly to the difference in their habits of growth. American synonyms for the species, *S. lacustris*, are listed by Potts[3] as follows (note the absence of "fluviatilis"):

1863 paupercula, Bowerbank;
1863 dawsoni, Bowerbank;
1875 flexispina, Dawson;
1879 lacustrioides, Potts;
1880 abortiva, Potts;
1880 mutica, Potts;
1880 montana, Potts;
1881 multiformis, Carter;
1884 lehighensis, Potts.

We gladly yield all claim of priority of discovery of this species in Massachusetts to Professor Remsen, and appreciate his calling the matter to our attention.

W. H. COLE,
D. POTTER

BIOLOGICAL LABORATORY,
CLARK UNIVERSITY

"BAR SINISTER"

I BEG leave to submit a line in defense of Professor Willis's delightful little fable, published in SCIENCE of May 29, from the imputation of involving a serious error in heraldry. It is true that the heraldic charge indicative of bastardy is the *baton sinister*, but the French name of this device is *barre sinistre;* the anglicized form of which term, *bar sinister*, has the sanction of centuries of usage.

ROBERT HAWXHURST, JR.
SAN FRANCISCO, CALIFORNIA

QUOTATIONS

SCIENTIFIC MEN AS UNIVERSITY PRESIDENTS

IT is gratifying to note that two of the great universities, Michigan and Chicago, have chosen as presidents men of exact scholarship—one a man of proved administrative ability also, and the other of a turn for practical affairs, but primarily a scientist of the purest type. The former, Dr. Clarence C. Little, the new president of the University of Michigan, a graduate of Harvard and a postgraduate student in science, conducted researches in genetics for many years, and became the assistant director of the Carnegie Institution for Experimental Evolution before he accepted the presidency of the University of Maine. His success there gives promise that the University of Michigan will have not only a competent administrator but a scholar who has gone out to the verge of human knowledge in at least one sector of the great field, and is able to appreciate the problems in every other sector, for the method of advance must

[1] SCIENCE, lxi, 391; 1925.

[2] Document 143, City of Boston, 1881; Report of Joint Standing Committee on Water.

[3] Potts, Proc. Acad. Nat. Sci., Philadelphia, 1887.

be the same whether one use a microscope, a telescope, a retort, a syllogism or an algebraic equation.

The University of Chicago has gone for its new president, Dr. Max Mason, to the University of Wisconsin. He is also preeminently a man of research, with a varied experience as a teacher, both in Eastern institutions and in the Middle West. His going to Chicago gives new emphasis to the purpose which has guided its development since its renaissance under that great scholar and teacher, Dr. William R. Harper, a purpose which has expressed itself in the motto "Let knowledge grow that life may be enriched," and has exemplified itself in practice by calling to university professorships such men as Chamberlin, Michelson, Hale and Millikan.

The faculties of the first of all American universities of the purest type were gathered about a teacher of mathematics, a teacher of Greek and a teacher of chemistry who were the first of scholars in their respective fields. And the University of Chicago owes its swift rise to its policy of gathering men of first-rate scholarship as its master teachers. This precedent has been followed in selecting the new leader. He is a mathematician, and if he needs defense in these days when all scientists are under Fundamentalist suspicion, it may be found in an admirable address delivered by David Eugene Smith before the Mathematical Association of America some years ago, entitled "Religio Mathematici." According to him, mathematics but increases the faith of a man who has faith, and while it shows him his finite nature with respect to the Infinite (for example, shows him that he can not construct a seven-edged polyhedron and is only combating the everlasting truth in trying to do so), it puts him in touch with immortality in the form of mathematical laws that are eternal.

In the midst of all the changes in things thought to be unchangeable it has been true, it is true and will be true throughout the universe and forever that $(a+b)^2 = a^2 + 2ab + b^2$. This is but one illustration of the immortality of law. A great mathematician, other things being equal, ought to be best prepared

> from facts compared the laws to trace
> Where long procession leads to Deity,

and so best prepared to lead on in further quest of truth.—Editorial from *The New York Times*.

SCIENTIFIC BOOKS

Fishes of the Gulf of Maine. By HENRY B. BIGELOW and WILLIAM W. WELSH. 1925. Bureau of Fisheries, XL, Part 1, pp. 1 to 567; figs. 1 to 278.

THIS is a bulletin just issued by the U. S. Bureau of Fisheries as part 1 of volume XL for 1924. It should be in the hands of all persons interested in the marine fishes of our eastern seaboard. The term Gulf of Maine as here used "covers the oceanic bight from Nantucket and Cape Cod on the west to Cape Sable on the east, thus including the shore lines of northern Massachusetts, New Hampshire, Maine and parts of New Brunswick and Nova Scotia." The 150 fathom contour has been chosen as the arbitrary offshore boundary of the region. Some 178 species are treated.

Looked at as a faunal work, this book is an adequate review of the cold-water group of fishes which is at home north of the long arm of Cape Cod, and penetrates only to a limited extent south of that cape, then mainly in winter. Descriptions of the species make of it a handbook for their ready identification, and it is very consistently illustrated with figures of each, and in many cases of their larval forms or fry also. It is comparable (except that fresh-water fishes are not included) to "The Fishes of North Carolina," by H. M. Smith, issued in 1907 by the North Carolina Geological and Economic Survey, and should prove equally useful. The two practically do not overlap; on the other hand they supplement one another admirably, one dealing with the cold-water, the other with the warm-water fauna of our eastern coast, north of Florida.

Advances have recently been made in knowledge of the breeding and life histories of marine fishes. Considerable data on this subject given by Bigelow and Welsh, when not new, is at least recent, and may conveniently be referred to in this volume. The young of sea fishes still offer a wide field for inquiry, in which Mr. Welsh was particularly interested, and that branch of the science of ichthyology has suffered an irreparable loss in his death. Fish migrations, a problem allied to oceanography, and one which has important economic bearings, is frequently discussed. Such discussion here is particularly interesting in view of Dr. Bigelow's knowledge of oceanography.

We look forward to the second part of this bulletin, which, as we understand it, will deal with the general biology and oceanography of the Gulf of Maine. As a memoir on the fishes this first part is complete in itself, ending with eighteen pages of bibliography and an index.

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SPECIAL ARTICLES

MUSCULAR FIXATION OF THE STUTTERER'S VOICE UNDER EMOTION

IT has been long known that stuttering is increased by an emotional experience. This fact should give

one a clue to an experimental attack upon the nature of the trouble. The voice of the stutterer can be studied under controlled emotional circumstances and, by a sufficiently refined technique, it ought to be possible to determine how these affect the voco-motor mechanism. This mechanism in its entirety is, of course, too complex and too extensvie to be brought within the scope of one experiment, but a part of it can be subjected to a single study.

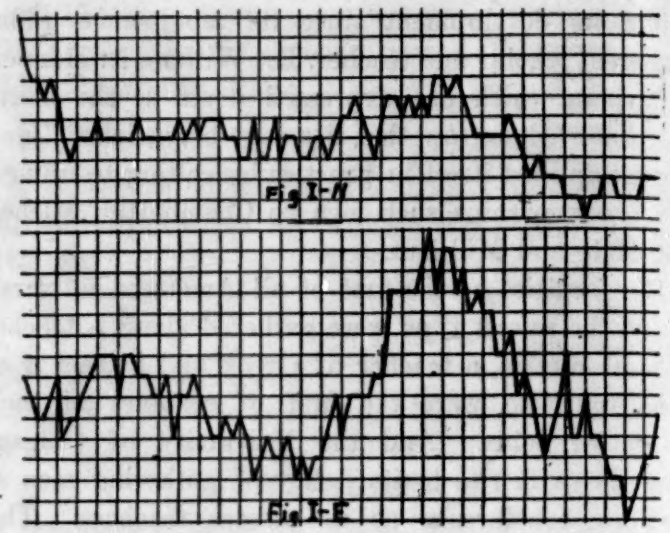
In the study, of which this is a preliminary report, I undertook to compare the changes produced in the voice of the stutterer under emotional conditions with the changes produced in the voice of the non-stutterer under like circumstances. These changes in the voice were detected and studied by means of the photographic method of recording speech. Nineteen stutterers and eighteen non-stutterers were studied under identical circumstances. The unemotional condition was as free from anything conducive to emotional arousal as possible. The observer was placed at ease by an explanation of the mechanics of the photographing apparatus, conversing about current topics, asking questions relative to athletic and scholastic interests and other quieting talk. When the observer seemed to be completely at ease he was required to sing a sustained "ah" into the photographing apparatus and a picture of this sound was taken.

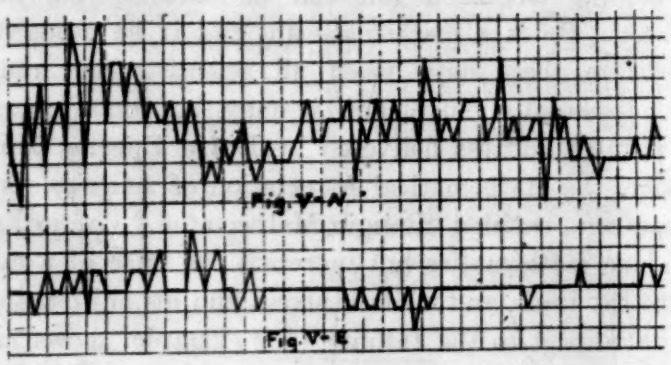
Immediately following the obtaining of this photograph, the observer was emotionally upset; first, by questioning and suggestions, second, by the firing of a pistol, and third, by an electrical shock. He was now asked to produce a tone as nearly like the one before as possible and a picture of this tone was taken.

The pictures of the voice were studied from the standpoint of fluctuations in wave length or pitch and measured with adequate precision. When I undertook the study I anticipated, in harmony with the fact of the emotions increasing stuttering, that the stutterer's voice would be much more upset after the emotional shock than the non-stutterer's. That is, I thought I would find greater variability in pitch in the case of the stutterer than in the case of the non-stutterer when the two had been subjected to the same emotional circumstances. To my surprise just the reverse was true, namely, that the stutterer has far less variability in pitch after an emotional shock than he does before, while a non-stutterer has more fluctuation in pitch after an emotional shock than before.

Thus we see that instead of the emotional upheaval producing a muscular lability in case of a stutterer, it produced a muscular fixation wherein the muscular balance that was taken to produce the "ah" was rigidly maintained.

The four following figures which are typical graphically illustrate the differences in effect of the emotive stimuli upon the voice of the stutterer and the non-stutterer. The ordinate scale gives the length of the waves .1 mm to a square, while the abscissa indicates





successive waves three to a square. Figure 1–N gives the wave-length fluctuations of a non-stutterer under the non-emotional condition, while Figure 1–E gives the wave-length fluctuations of the same non-stutterer after the emotional upset. It is easy to see the greater number and extent of changes in wave-length or pitch for Figure 1–E. Figure V–N gives the wave length fluctuations of a stutterer under non-emotional conditions while Figure V–E gives wave-length fluctuations of the same stutterer after the pistol shot and the electrical shock. In these two figures, notice the marked elimination of wave-length changes for Figure V–E. Whether this muscular fixation in the case of the stutterer extends to muscles other than those controlling voice production this study can not answer. Neither can it answer the question, What is responsible for the muscular fixation of the stutterer after an emotional shock? This latter question, however, is being investigated at the present time.

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